

HIGHLY CONFIDENTIAL – SUBJECT TO CONFIDENTIALITY ORDER

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OHIO
EASTERN DIVISION**

IN RE NATIONAL PRESCRIPTION	:	MDL No. 2804
OPIATE LITIGATION	:	CASE NO. 17-MD-2804 (DAP)
	:	
	:	

Expert Report of Rob Lyerla, PhD MGIS

May 10, 2019

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I. INTRODUCTION

A. Qualifications

1. My name is Dr. Robin Lyerla. I am a Professor in the Interdisciplinary Health Sciences PhD program at Western Michigan University (“WMU”) and a former Captain in the U.S. Public Health Service. My principal research interests include facets of epidemiology concerned with public health surveillance, behavioral health, community resiliency as a public health intervention, community infrastructure assessment, and geographic analysis of public health data.

2. I received a BS in Biological Sciences from Bradley University in 1979 and completed a PhD in Measurement and Statistics at Southern Illinois University-Carbondale in 1994. In 1995, I entered the Epidemic Intelligence Service, a two-year training program in field epidemiology at the Centers for Disease Control and Prevention (“CDC”). In 2016, I obtained a Master of Geographic Information Systems degree from Pennsylvania State University. A more complete description of my qualifications is found in my Curriculum Vitae, attached hereto as Exhibit A.

3. At WMU, I teach basic and advanced statistical methods to PhD level students. Prior to coming to WMU in the spring of 2018, I served for over 20 years in the U.S. Public Health Service, retiring as a Captain in the spring of 2018. I entered public service in 1995 as a member of the Epidemic Intelligence Service (“EIS”) at CDC, and then remained at CDC-Atlanta as a staff epidemiologist in the Division of Viral Hepatitis until 2004. In 2004, I was assigned by CDC to the Joint United Nations Programme on HIV/AIDS (UNAIDS) in Geneva, Switzerland. At UNAIDS I was a staff epidemiologist from 2004 to 2007, and then became a branch chief there in 2007 until 2009, when my five-year tour ended and I returned to the U.S. I served a brief year at NIH from 2009-2010, and in 2010 was seconded to The President’s Emergency Plan for AIDS Relief (“PEPFAR”), where I served as the Deputy Director for Strategic Information until 2013.

4. In 2013 I moved to the Substance Abuse and Mental Health Services Administration (“SAMHSA”). In 2014, I became the acting Division Director for the Division of Evaluation, Analysis and Quality, and in 2015, I was named the first Associate Director for Science for the Center for Behavioral Health Statistics and Quality. I remained in that position until I retired from federal service in January of 2018. Upon arriving at SAMHSA, I became aware of the gaps in the national capacity to confidently track behavioral health trends. I have worked since that time to support the development of a national surveillance system for behavioral health that mirrors the type of system we have for infectious diseases. I have published in that domain.

5. My rate of compensation in this matter is \$500.00 per hour. My compensation does not depend on the outcome of this proceeding.

B. Assignment and Materials Considered

6. I have been asked by counsel for Mallinckrodt LLC and SpecGx LLC (together “Mallinckrodt”) to review the expert reports produced by the Track One Plaintiffs, in particular those opinions related to epidemiology, which I understand are found primarily in the reports of

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David Cutler, Jonathan Gruber, Katherine Keyes, and Anna Lembke (together “Plaintiffs’ Experts” or “Plaintiffs’ experts”). I am providing this opinion on behalf of Mallinckrodt as well as the Janssen defendants, the Purdue defendants, the Endo and Par defendants, the Teva and Actavis generic defendants, and the Allergan defendants. Each of these reports purports to reach epidemiological conclusions that Plaintiffs and their other experts rely upon, including for calculating what I understand to be Plaintiffs’ alleged damages and abatement costs. I have reviewed these reports from an epidemiological perspective to assess fundamental assumptions these experts have made to support their opinions. I understand that other Plaintiff expert reports that rely on these epidemiological assumptions are being addressed by other experts in this litigation. Where appropriate, I refer to the opinions that I understand are being offered by those other rebuttal experts in this report.

7. I have also been asked by counsel for Mallinckrodt to evaluate to a reasonable degree of epidemiological certainty the Track One Plaintiffs’ assessments regarding (i) the nature of any “epidemic” related to opioids (as that term is used by Plaintiffs and in the field of epidemiology); and (ii) whether that alleged epidemic is attributable to prescription opioids and the conduct alleged in the Plaintiffs’ complaints. In making these assessments, I have been asked to evaluate, as an epidemiologist, the validity of Plaintiffs’ “gateway” hypothesis that misuse of and addiction to prescription opioids resulted in rising abuse of street drugs like heroin and illicit fentanyl. In making these assessments, I also explore multiple socioeconomic factors that, based on my training and experience as an epidemiologist, are relevant independent causal factors that Plaintiffs’ experts erroneously neglected to address.

8. In preparing this report, I reviewed epidemiological and scientific literature, Plaintiffs’ expert reports, court filings, certain documents produced in the course of this litigation, and transcripts of certain depositions taken in this litigation. I have also relied on my more than 20 years of professional experience as an epidemiologist and my understanding of published and peer-reviewed epidemiological literature. A list of materials that I have considered is attached as Exhibit B.

II. SUMMARY OF OPINIONS

9. As explained below, there has historically been, and continues to be, a certain background level of drug usage in the United States. As part of this observed background, levels of opioid misuse have remained consistent for years. What appears to have increased are opioid overdoses and mortalities.

10. Plaintiffs’ “gateway” hypothesis that people who consume prescription opioids transition to illicit opioid use largely relies on retrospective studies, which suggest association, not causality. Studies on the issue suggest that medical use of opioids as prescribed does not cause opioid use disorder.¹

¹ McCabe, S. E., Veliz, P. T., Boyd, C. J., Schepis, T. S., McCabe, V. V., & Schulenberg, J. E. (2019) A prospective study of nonmedical use of prescription opioids during adolescence and subsequent substance use disorder symptoms in early midlife. *Drug and Alcohol Dependence*, 194, 377-385. doi:10.1016/j.drugalcdep.2018.10.027, p. 381.

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11. From an epidemiology perspective, the data Plaintiffs’ experts use to support their causal theories are inadequate. Inconsistent reporting and reporting biases prevent Plaintiffs from establishing their claims. Indeed, Plaintiffs’ documents and witnesses recognize the limitations of the data on which Plaintiffs’ experts rely. Rather than recognize the unavailability of reliable data, Plaintiffs make their claims without sufficient support.

12. Plaintiffs’ experts fail to consider other relevant and significant factors contributing to opioid overdoses and mortality.

III. BACKGROUND DRUG USAGE PREVALANCE REMAINS STABLE OVER TIME

13. An epidemic is defined as the “occurrence in a community or region of cases of an illness, specific health-related behavior, or other health-related events clearly in excess of normal expectancy” and where the “community or region and the period in which cases occur are specified precisely.”² Adequately assessing an epidemic requires establishment of baseline criteria, including the normal expected occurrence of disease as well as comprehensive case definitions regarding the disease and its geographic and temporal scope of incidence. There must exist a previously recognized background rate of occurrence of the disease in the general population in order to accurately determine whether the increased rates of occurrence are, in fact, an epidemic.³

14. The National Survey on Drug Use and Health (“NSDUH”)⁴ data show consistent rates of use over extended durations for many substances, including various opioids, licit and illicit. For example, the 2017 NSDUH study showed that past year heroin use among individuals 12 or older stayed below 0.5% for each year between 2002 and 2017, inclusive.⁵ The lack of substantial variation among these prevalence rates suggests the existence of a baseline occurrence. This concept of baseline rates exists in other health conditions as well.⁶

15. With regard to prescription pain relievers, NSDUH data suggest that the rate of nonmedical use of prescription pain relievers has in fact remained stable in the United States, hovering around two percent for the population 12 years and older between 2002 and 2014.⁷ These

² Last J. M. (2001). *A dictionary of epidemiology: fourth edition*. New York, NY: Oxford University Press.

³ Nuzzo, J. (2018). Determining the infectious disease baseline to support outbreak detection in the U.S. *Johns Hopkins Center for Health Security, Outbreak Observatory*. Retrieved from <https://www.outbreakobservatory.org/outbreakthursday-1/4/5/2018/determining-the-infectious-disease-baseline-to-support-outbreak-detection-in-the-us>.

⁴ I discuss NSDUH in more detail in Section V.

⁵ Substance Abuse and Mental Health Services Administration. (2018). *Key Substance Use and Mental Health Indicators in the United States: Results from the 2017 National Survey on Drug Use and Health* (HHS Publication No. SMA 18-5068, NSDUH Series H-53). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, p. 19 (Figure 22). Retrieved from <https://www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHF2017/NSDUHF2017.pdf>.

⁶ el Bcheraoui C., Mokdad A. H., Dwyer-Lindgren L., Bertozzi-Villa, A., Stubbs, R. W., Morozoff, C. ... Murray, J. L. (2018). Trends and patterns of differences in infectious disease mortality among US counties, 1980-2014. *JAMA*, 319(12), 1248–1260. doi:10.1001/jama.2018.2089.

⁷ Substance Abuse and Mental Health Services Administration. (2014). *Behavioral health trends in the United States: results from the 2014 national survey on drug use and health* (HHS Publication No. SMA 15-4927, NSDUH

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use patterns may have actually declined since 2010.⁸ It should be noted, however, that the declines are small, and may reflect a normal variation around a population moving average.⁹

16. There is little work in establishing population level behaviors for substance use disorder, opioid use disorder, and related conditions. There is also no agreed-upon consensus on what level of behaviors is simply a facet of population-level health.¹⁰

17. What appears to be changing over time are drug overdoses and deaths. But, as discussed below, inconsistencies in cause of death definitions across jurisdictions create challenges for attributing cause of death. In addition, not every population group is experiencing increased mortality related to opioids. Despite the challenges in attributing cause of death, increases in mortality generally can be evaluated. There does appear to be an increase in mortality among white men aged 25-64 years old in some jurisdictions, putting aside cause of death.¹¹ These may be evaluated as proxies for death by overdose related to opioids, but it still remains that the inconsistencies in attribution are problematic.

IV. PLAINTIFFS’ GATEWAY HYPOTHESIS IS UNSUPPORTED BY EVIDENCE

18. Three of Plaintiffs’ expert witnesses, Professor Gruber, Professor Keyes, and Dr. Lembke, each present some form of a “gateway” hypothesis, as described above. Professor Gruber looks at prescription opioid shipments and illicit opioid mortality and determines that the decline in shipments caused increased heroin mortality.¹² He writes that epidemiological “studies establish that prescription opioids have become the predominant gateway to heroin use.”¹³ Professor Keyes posits that “[t]he available evidence demonstrates that prescription opioid use causally increases the risk for heroin use.”¹⁴ Based on her review of certain studies, Professor Keyes writes that “the

Series H-50). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Figure 6. Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf>.

⁸ Lipari, R. N., Van Horn, S. L., Hughes, A., and Williams, M. (2017). *The CBHSQ Report: State and substate estimates of nonmedical use of prescription pain relievers*. Rockville, MD: Substance Abuse and Mental Health Services Administration. Retrieved from https://www.samhsa.gov/data/sites/default/files/report_3187/ShortReport-3187.html.

⁹ Last J. M., (2001). A moving average is “a method of smoothing irregularities in trend data, such as long-term secular trends in incidence or mortality rates,” p.118.

¹⁰ Office of Disease Prevention and Health Promotion. (2019). *Healthy People 2020: Substance abuse*. Washington D.C.: Office of Department and Human Services. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/substance-abuse>.

¹¹ Woolf, S. H., Chapman, D. A., Buchanich, J. M., Bobby, K. J., Zimmerman, E. B., and Blackburn, S. M. (2018). Changes in midlife death rates across racial and ethnic groups in the United States: systematic analysis of vital statistics. *BMJ* 2018;362:k3096. Retrieved from <https://doi.org/10.1136/bmj.k3096>.

¹² Expert Report of Professor Jonathan Gruber, in this matter, March 25, 2019, pp. 12-70. (Hereinafter “Gruber Report”)

¹³ Gruber Report, p. 62.

¹⁴ Expert Report of Professor Katherine Keyes, in this matter, March 24, 2019, pp. 25-26 (hereinafter “Keyes Report”); see also Gruber Report, p. 63 (“In a 2013 study, Muhuri *et al.* also analyze data from NSDUH and find ‘a

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proportion initiating heroin increases in a dose-response relationship with the extent and length of prescription opioid use, providing further support for a causal relationship.”¹⁵ Dr. Lembke similarly hypothesizes that a “Gateway Effect” caused individuals “who otherwise would not have been exposed to opioids to be exposed and become addicted” to them, “including individuals who turned from prescription opioids to illicit sources of opioids such as heroin.”¹⁶

19. As a general matter, the idea of a gateway hypothesis gained prominence in the 1970s following the observation of Kandel (1975) on the basis of data from two longitudinal surveys of random samples of New York high school students that some of the students who consumed tobacco and alcohol went on to use marijuana and other illicit drugs.¹⁷ Progression, Kandel wrote, “follows the sequence from nonuse to legal drugs to cannabis to pills to psychedelics to cocaine to heroin.”¹⁸ While Kandel advanced the hypothesis decades ago, scholars and researchers (including its original proponent) continue to evaluate and debate its weaknesses and shortcomings.¹⁹ In the forward of a book edited by Kandel, Leshner (2002) highlighted that “there is no single factor that determines whether a person might abuse a substance; instead, substance abuse develops from the interaction of complex biological, psychological, and social/environmental determinants.”²⁰

20. In epidemiology, and in particular for behavioral health conditions, causal relationships, such as the one that the gateway hypothesis suggests, are difficult to substantiate. This is particularly so when the observed conditions and behaviors implicate multiple, overlapping, potentially contributing factors and confounders. Confounders are variables that can cause the observed outcome, even though they are not themselves the subject of study.²¹ Confounders complicate the establishment of causal relationships because, unless they are adjusted or accounted for, their effects cannot be distinguished from the effects of the factors under investigation.²²

21. Most epidemiological studies or investigations are observational—or retrospective—rather than experimental.²³ Observational studies have limitations; they feature

strong association between prior nonmedical use of pain relievers and the subsequent past year initiation of heroin use.”).

¹⁵ Keyes Report, p. 27.

¹⁶ Expert Report of Dr. Anna Lembke, in this matter, March 25, 2019, p. 86. (Hereinafter “Lembke Report”)

¹⁷ Kandel, D. (1975). Stages in adolescent involvement in drug use. *Science*, 190 (4217), 912-914. doi:10.1126/science.1188374.

¹⁸ Kandel, (1975), p. 913.

¹⁹ Kandel, D. B. (Ed.). (2002). *Stages and pathways of drug involvement: Examining the gateway hypothesis*. Cambridge: Cambridge University Press. p. 3.

²⁰ Leshner, A. I. (2002). Foreword. In *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. xiii-xiv). Cambridge: Cambridge University Press.

²¹ Last, (2001), pp. 37-38.

²² Last, (2001), p. 38.

²³ Rothman, K. J., Greenland, S., & Lash, T. L. (2012). *Modern Epidemiology* (3rd ed.). Philadelphia: Wolters Kluwer Health, p. 87-89.

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errors associated with bias, chance, and confounding factors.²⁴ Therefore, an observed statistical association between a risk factor and a disease does not necessarily establish a causal relationship between that risk factor and the resulting condition.²⁵ Additionally, observational studies cannot address temporal ordering of events, and there may be unidentified confounders related to the outcome.²⁶ For events with low background rates, including opioid use disorder in the national population, retrospective studies face further challenges in identifying association, and specifically, causation.²⁷ Nevertheless, these studies are more common in epidemiology because they often use readily accessible large sets of data.

22. By contrast, prospective studies, such as longitudinal cohort studies, constitute a textbook standard for supporting the validity of a causal relationship.²⁸ These studies track a group of people over some period of time to examine how factors affect rates of a certain outcome. These studies are inherently time-consuming and expensive to perform. There are few in this field relating to prescription opioid use. McCabe (2019) observed that “[d]espite the public health concerns regarding opioid-related consequences, there remains a paucity of prospective longitudinal research that examines characteristics associated with [nonmedical use of prescription opioids (“NMUPO”)] (e.g., frequency, motives, co-ingestion, and medical/NMUPO initiation) during adolescence and their relationship with later substance-related problems in adulthood.”²⁹

23. Plaintiffs’ experts largely rely on observational studies to support their gateway hypothesis.³⁰ But their relied-upon retrospective studies that examine historical drug use and misuse cannot control for important factors and confounders. For example, these studies cannot tease out the temporal ordering of co-occurring conditions

24. Some of the studies on which Plaintiffs’ experts rely suggest an association between *non*-medical use of prescription opioids and illegal drug use. For example, Gruber cites Muhuri (2013) for the proposition that NSDUH data shows “a strong association between prior nonmedical use of pain relievers and the subsequent past year initiation of heroin use.”³¹ Yet individuals initiating heroin use constitute a very small population compared to those who have ever been prescribed a prescription opioid. Muhuri found that the overall rate of heroin initiation was 0.07%

²⁴ Rothman *et al.*, (2012), pp. 93-97, 129-137.

²⁵ Rothman *et al.*, (2012), pp. 93-94.

²⁶ Last, (2001), pp. 37-38.

²⁷ Mann, C. J. (2003). Observational research methods. Research design II: Cohort, cross sectional, and case-control studies. *Emergency Medicine Journal*, 20(1), 54-60. doi:10.1136/emj.20.1.54.

²⁸ Last, (2001), pp. 33-34.

²⁹ McCabe *et al.*, (2019), p.378.

³⁰ See e.g., Compton, W. M., Jones, C. M., & Baldwin, G. T. (2016). Relationship between nonmedical prescription-opioid use and heroin use. *New England Journal of Medicine*, 374:154-163. 10.1056/NEJMr1508490, p.156.

³¹ Gruber Report, p. 63; Muhuri, P. K., Gfroerer, J. C., & Davies, M. C. (2013). *CBHSQ Data Review: Associations of nonmedical pain reliever use and initiation of heroin use in the United States*. Rockville, MD: Substance Abuse and Mental Health Services Administration. Retrieved from <https://www.samhsa.gov/data/sites/default/files/DR006/DR006/nonmedical-pain-reliever-use-2013.htm>.

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during 2005-08 and 0.11% during 2009-11.³² Most non-medical users of pain relievers (like prescription opioids), Muhuri concluded, “do not progress to heroin use.”³³ Professor Keyes therefore acknowledges, citing Muhuri, that a “small proportion of individuals who use prescription opioids progress to heroin use.”³⁴ Moreover, this group is also likely to have other comorbid presentations such as mental health issues, and tends to include younger males, and uninsured and lower income populations that are already at risk for substance abuse and other conditions.³⁵

25. A 2015 SAMHSA report produced by Plaintiffs states, “The concern that efforts to prevent the illegal use of prescription opioids are causing people to turn to heroin *is not supported by the trend*. In 2013, there were 169,000 past year heroin initiates, which is similar to the number of initiates in most years since 2002. *Although research indicates that people who previously misused prescription pain relievers were more likely to initiate heroin use than people who had not misused prescription pain relievers, most people who misuse prescription pain relievers do not progress to heroin use.*”³⁶

26. Similarly, a 2015 CDC report, also included in Plaintiffs’ documents, found that “[a]lthough it has been postulated that efforts to curb opioid prescribing, resulting in restricted prescription opioid access, have fueled heroin use and overdose, a recent analysis of 2010-2012 drug overdose deaths in 28 states found that decreases in prescription opioid death rates within a state were not associated with increases in heroin death rates; in fact, increases in heroin overdose death rates were associated with increases in prescription opioid overdose death rates.”³⁷ Increased availability and lower price of heroin were identified as potential contributors to rising heroin use rates.³⁸

27. Further, literature from key witnesses in the Bellwether counties (Cuyahoga County and Summit County) acknowledge that the gateway hypothesis lacks support. Thomas Gilson, the Cuyahoga Medical Examiner, wrote that “there is a dearth of firm evidence establishing the role of [opioid pain relievers] as a gateway to heroin Our prescription drug monitoring program data clearly establish a link between [opioid pain relievers] use and [deaths associated with heroin], but it is unclear whether this represents evidence of a transition between [opioid pain relievers] and heroin or simply reflects an addict population that uses these substances interchangeably.”³⁹

³² Muhuri *et al.*, (2013), p. 5.

³³ Muhuri *et al.*, (2013), p. 14.

³⁴ Keyes Report, p. 27.

³⁵ Muhuri *et al.*, (2013), pp. 5-7; Compton *et al.*, (2016), p. 159.

³⁶ “Trends in Heroin Use in the United States: 2002 to 2013” (2015), CLEVE_000118926 at 9 (emphasis added).

³⁷ “Vital Signs: Demographic and Substance Use Trends Among Heroin Users-United States, 2002-2013” (2015), CLEVE_000118755 at 2.

³⁸ “Vital Signs: Demographic and Substance Use Trends Among Heroin Users-United States, 2002-2013” (2015), CLEVE_000118755 at 5.

³⁹ “The Cuyahoga County Heroin Epidemic” (2014), CUYAH_009397824 at 111.

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It appears that an earlier version of the article states that the majority of deaths associated with heroin were of individuals known to abuse drugs.⁴⁰

28. Notably, the literature indicates that *proper medical* use of prescription opioids is not causally related to substance abuse. To begin with, as discussed above, opioid misuse is uncommon.⁴¹ Even more importantly, as discussed below, NSDUH’s definition of “misuse” is broad and could include users who took a prescribed opioid even once more than directed.⁴² In her deposition, Professor Lembke has indicated that she has not tested the percentage of individuals ultimately addicted to illicit opioids who started out with no substance abuse history and whose initial exposure to opioids was via a medically appropriate prescription of an opioid medication.⁴³

29. McCabe (2019) published one of the first prospective, longitudinal studies examining non-medical prescription opioid substance abuse across a large population. The study followed approximately 17,000 U.S. high school seniors over a 17-year period.⁴⁴ McCabe demonstrated that *proper medical use* of prescription opioids *does not lead to increased risks of long-term addiction to opioids*.⁴⁵ Since we now have at least one robust prospective study regarding opioid use, we should recognize the strength that prospective studies bring to the discussion of causality, and the limitations of retrospective studies.

V. PLAINTIFFS’ DATA DO NOT SUPPORT THEIR CONCLUSIONS

30. Plaintiffs’ experts purport to demonstrate a causal relationship between prescription opioid use and opioid misuse and mortality. However, the data they use are insufficient to support their conclusions.

31. In the United States, with many infectious diseases and conditions of public health importance, cases are identified and reported at a local level to the state health department. This is most often accomplished in collaboration with the Council of State and Territorial Epidemiologists (“CSTE”), which annually reviews case definitions and agreements about reporting requirements at the annual CSTE Meeting. This mechanism assists in assuring reliable counts of cases at a national level. Over time, the reportable conditions, case definitions, and reporting requirements have been modified as technology improves and disease occurrence moderates (either increases or decreases). When a new condition presents itself in the United States population, the mechanisms for nationally notifiable and reportable conditions moves through this process so that states and counties can accurately count, attribute, and verify legitimate cases of a condition.

⁴⁰ “The Cuyahoga County Heroin Epidemic” (2013), CUYAH_009447039 at 4.

⁴¹ See Section III.

⁴² See Section V.A.

⁴³ Deposition of Professor Anna Lembke (April 24, 2019), pp. 81-82. (Hereinafter “Lembke Deposition”)

⁴⁴ McCabe *et al.*, (2019), p. 378.

⁴⁵ McCabe *et al.*, (2019), p. 381.

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32. For behavioral health,⁴⁶ there is no nationally established behavioral health surveillance system in the United States. Only recently has the CSTE begun to pilot test the utility of a set of behavioral health indicators that could someday lead to a national behavioral health surveillance system. Until then, surveys have been used to assess behavioral health conditions. These surveys are not intended to determine aberrations from a baseline but rather are only intended to show prevalence at a point in time, and potentially provide insight into changes over time in that prevalence value.

A. The National Survey on Drug Use and Health

33. Plaintiffs' experts, including Professor Cutler and Professor Gruber, rely on data from the National Survey on Drug Use and Health ("NSDUH") to discuss opioid misuse and opioid use disorder ("OUD").⁴⁷ NSDUH is a large nationally representative survey that has been conducted by the U.S. Government since 1971.⁴⁸ Every year, roughly 70,000 people are surveyed for inclusion in the study, using weighted design to ensure proper representation of all important demographic categories. From 1999 through 2013, most states had a sample size of 900, though larger states quadrupled that sample size.⁴⁹ Starting in 2014, the sample sizes changed such that the larger states had a sample size proportional to their population, and the smaller states had a slightly increased sample size.⁵⁰ National estimates of use of illegal drugs, prescription drugs, alcohol and tobacco, as well as estimates of mental disorders, treatment and co-occurring substance use, and mental disorders are calculated. State-based estimates are calculated every two years, pooling data from two consecutive years in order to obtain a sample size large enough for stable estimates.⁵¹ NSDUH collects data through face-to-face interviews of U.S. civilians older than 12 years who are not institutionalized.⁵² It does not include people who are homeless but not in

⁴⁶ Behavioral health is defined as "mental/emotional well-being and/or actions that affect wellness. Behavioral health problems include substance use disorders; alcohol and drug addiction; and serious psychological distress, suicide, and mental disorders. Problems that range from unhealthy stress or subclinical conditions to diagnosable and treatable diseases such as serious mental illnesses and substance use disorders are included." Lyerla R. & Stroup, D.F. (2018). Toward a Public Health Surveillance System for Behavioral Health. *Public Health Reports* 133, 4.

⁴⁷ Gruber Report, at ¶ 30.

⁴⁸ Substance Abuse and Mental Health Services Administration. (2017). *2016 National Survey on Drug Use and Health: Methodological summary and definitions*. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. p. 1. Available at <https://www.samhsa.gov/data/sites/default/files/NSDUH-MethodSummDefs-2016/NSDUH-MethodSummDefs-2016.pdf>. (Hereinafter "2017 NSDUH Methodology")

⁴⁹ Substance Abuse and Mental Health Services Administration . (2017). *2016-2017 NSDUH: Guide to state tables and summary of SAE methodology*. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Available at <https://www.samhsa.gov/data/report/2016-2017-nsduh-guide-state-tables-and-summary-sae-methodology>. (Hereinafter "2016-2017 NSDUH Guide")

⁵⁰ 2016-2017 NSDUH Guide, p. A-3.

⁵¹ 2016-2017 NSDUH Guide, p. A-5.

⁵² 2017 NSDUH Methodology, p. 1

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shelters, military personnel on active duty, or those residents of institutional group quarters, such as jails and hospitals.⁵³ Participants receive \$30 for completing the interview.⁵⁴

34. NSDUH a major source of statistical information on the use of illicit drugs, alcohol, and mental health issues among members of the U.S. civilian population 12 and older. NSDUH is a completely self-reported instrument with a broad definition of misuse. The definition of misuse encompasses use of prescription pain relievers “in any way a doctor did not direct you to use it.”⁵⁵ It includes anyone who self-reports by answering “yes” to include (1) use without a prescription; (2) use of a prescription pain reliever in greater amounts, more often, or longer than directed; or (3) use in any other way not directed by a doctor (including one-time use, more than prescribed in a given day, etc.).⁵⁶ That is, someone could “misuse” a prescription pain reliever not only by stealing and taking prescription opioids but also by taking an opioid appropriately prescribed for him or her one more time per day than the prescription directs. Unfortunately, this nuance is missed. Second, NSDUH requires a series of questions to determine if an individual might be categorized as misusing or having a “disorder.” The survey does not ask respondents to self-report “I have a disorder.” Again, of particular importance is the definition used in NSDUH of Substance Use Disorder (“SUD”). NSDUH defines SUD as meeting the criteria in the DSM for either *dependence* or *abuse* for illicit drugs or alcohol, which includes a wide variety of criteria.⁵⁷ This wide range suggests a potential overestimation of serious SUD.

35. Professor Gruber suggests that NSDUH data underestimates opioid misuse and OUD based on sampling and participant responsiveness.⁵⁸ The populations that are not part of NSDUH actually account for a very small portion of the U.S. population (note, rate of

⁵³ 2017 NSDUH Methodology, p. 1.

⁵⁴ National Survey on Drug Use and Health. About the Survey. Retrieved from https://nsduhweb.rti.org/respweb/about_nsduh.html.

⁵⁵ See, for example, the 2019 National Survey on Drug Use and Health survey instrument, available at <https://www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHmrbCAISpecs2019.pdf>. Prior to 2015, the National Survey on Drug Use and Health used the term “nonmedical use of prescription drugs,” defined as “use of prescription drugs that were not prescribed for an individual or were taken only for the experience or feeling that the drugs caused.” Hughes, A., Williams, M. R., Lipari, R. N., Bose, J., (2016). *Prescription drug use and misuse in the United States: Results from the 2015 National Survey on Drug Use and Health*. Rockville MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Available at <https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR2-2015/NSDUH-FFR2-2015.htm>. (Hereinafter “2015 NSDUH Prescription Drug Abuse”)

⁵⁶ 2015 NSDUH Prescription Drug Abuse.

⁵⁷ 2017 NSDUH Methodology, p. 169.

⁵⁸ Gruber Report at ¶ 31.

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homelessness in the U.S. is 0.17%,⁵⁹ 0.6% incarcerated,⁶⁰ 0.3% in military⁶¹). Professor Gruber does not demonstrate how the absence of these populations affects the data.

36. Like Professor Gruber, Professor Cutler relies on NSDUH data. Professor Cutler uses NSDUH data to estimate share of “drug-related” crimes (crimes committed while on drugs) attributable to opioids.⁶² Data collected in NSDUH are not collected with any regard to association for drug-related crimes. It is commonly understood in the field of epidemiology (and other sciences) that data collected for one purpose should not be used for other purposes that are outside the scope of the original intent of the data collection. While the National Forensic Laboratory Information System data may be used for law enforcement purposes, the NSDUH data is not, and it is not good scientific practice to stretch the data’s intent this way.

B. Overdose and Mortality Data

37. The mortality reporting system in place during the period of time of Plaintiffs’ complaints was frail and unreliable. The lack of uniform reporting precludes the capacity to evaluate the rate of overdoses over time. Variations in coding, laboratory protocols, medical examiner protocols, and public awareness are all confounding factors that must be addressed in order to more scientifically evaluate the size of the increase in opioid overdose rates.

38. In October 2018, the CDC set forth a case definition of nonfatal drug overdose.⁶³ Until then, there were no national standards on overdose reporting. While there have been efforts to create nationally-reportable case definitions related to drug overdoses such as drug-overdose mortality rate (through the CSTE), there has been no consistent national method for collecting and then ultimately detecting the true nature of deaths attributable to opioids.

39. As just discussed, cause of death reporting is inconsistent across time, across states, and across medical examiners. Identifying the “cause” of an overdose may be inconsistent when multiple substances are involved, and the data itself may not capture which drugs were involved.⁶⁴

⁵⁹ Henry, M., Mahathay, A., Morrill, T., Robinson, A., Shivji, A., & Watt, R. (2018). *The 2018 Annual Homeless Assessment Report (AHAR) to Congress, Part 1: Point-In-Time Estimates of Homelessness*. Washington D.C.: United States Department of Housing and Urban Development, p. 1; United States Census Bureau. (2018). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018*. p. 4.

⁶⁰ Kaeble, D., & Cowhig, M. (2018). *Correctional Populations in the United States, 2016*. Washington D.C.: United States Department of Justice. p. 1; United States Census Bureau. (2018). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018*. p. 3.

⁶¹ United States Department of Defense, Office of the Secretary of Defense. (2018). *Military and Civilian Personnel by Service/Agency by State/Country (Updated Quarterly), December 2018*. United States Census Bureau. (2018). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018*. p. 4.

⁶² Expert Report of David Cutler, in this matter, March 25, 2019, at ¶ 39. (Hereinafter “Cutler Report”) Drug-related crimes are those “undertaken while on drugs.” Cutler Report, at ¶ 38.

⁶³ Centers for Disease Control and Prevention (2018). Opioid Overdose: Nonfatal Drug Overdose. Retrieved from <https://www.cdc.gov/drugoverdose/data/nonfatal.html#tabs-2-5>.

⁶⁴ Warner, M., Paulozzi L.J., Nolte K.B., Davis G.G., Nelson L.S. (2013) State variation in certifying manner of death and drugs involved in drug intoxication deaths. *AFP Journal* 3(2):231–37.

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Ruhm (2017) discusses several of the inaccuracies in and challenges of reporting drug fatalities.⁶⁵ Further, variations in primary and secondary cause of death are influenced by local capacity (medical examiner, county coroner, emergency department staff recognition of cause), concern for family (since many deaths due to illegal activities prevent insurance claims from being awarded), and other factors.⁶⁶ Variations still exist in reporting due to local laboratory capacity, and certainly there is the potential for reporting bias—meaning that increases in reporting may be related to awareness and capacity, not necessarily real changes in events. It is possible that, since the start of public discourse about opioids and news reports of the “opioid epidemic,” reporting by providers on death certificates may be influenced by the quantity of public discourse on the topic. In short, there are inconsistencies across laboratories, emergency departments, medical examiners, geographies, and time frames in the recording of cause of death. This makes using such data across time problematic and unreliable.

40. Both Professor Gruber and Professor Cutler rely on national mortality data. However, these experts do not address the fundamental threats to the validity of death records. Has there been a change in the protocols of the medical examiners? Has it been established that the protocols in place (including laboratory case definitions and consistent laboratory protocols for testing samples) have been consistent and consistently applied over the last 20 years? Are there reports of quality control suggesting that there have been no threats to the validity of the reported cause of death? Have the International Classification of Diseases (“ICD”) and transaction (“T”) codes been used reliably being over the last 20 years? Plaintiffs’ experts do not provide answers to these questions.

C. Evidence from Cuyahoga and Summit Counties

41. Plaintiffs’ documents reveal the problems with medical examiner data and inconsistent reporting, even on a state or county level.⁶⁷ Documents from Summit County suggest that laboratory testing and equipment issues interfered with medical examiners’ ability to confirm the presence of fentanyl upon death, thus calling into question the reliability of the data upon which the experts rely.⁶⁸

⁶⁵ Ruhm, C. J. (2017). Geographic variation in opioid and heroin involved drug poisoning mortality rates. *American Journal of Preventive Medicine*, 53(6),745-753. DOI: <https://doi.org/10.1016/j.amepre.2017.06.009>.

⁶⁶ Warner M. *et al.*, (2013) p. 747.

⁶⁷ For example, see “Meeting with ODH on overdose data” (2012), OhioMHAS B 196 (2012 notes from meeting with Ohio Department of Health discussing problems with overdose data); “The Cuyahoga County Heroin Epidemic” (2013), CUYAH_009397824 at 110 (Cuyahoga County Medical Examiner Thomas Gilson co-authored article stating that “[d]eaths due to heroin intoxication alone (versus mixed intoxications) are not routinely tracked at our office but in 2012 represented 33% of” deaths associated with heroin); “Email Thread: Fw: carfentanil screening” SUMMIT_000029998 (discussion about whether a positive urine test is sufficient to pronounce the death a carfentanil overdose).

⁶⁸ See “Email Thread: Re: ” SUMMIT_000118269 (emails between Steve Perch and Siemens-Healthineers in April 2017, about the Summit County’s fentanyl assay being unreliable); “Email Thread: Fentanyl” SUMMIT_000118492 (emails between Steve Perch and Immunalysis in September 2016, discussing Summit County Medical Examiner’s Office being unable to confirm positive results for fentanyl due to testing issues); “From: Steve Perch – Toxicologist, Summit County Medical Examiner’s Office, Item Update on Fentanyl” SUMMIT_000031545 (Steve Perch, a toxicologist from Summit County Medical Examiner’s Office, stating in a 2017 memo that he had begun to

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42. Plaintiffs’ witnesses and representatives also recognize significant limitations in their data, including inaccurate reporting, inconsistent methodologies, and unreliable data gathering. Lisa Kohler, the Summit County Chief Medical Examiner, admitted that there were limitations on data and lab testing due to lack of a consistent protocol for determining which drug was listed as well as a “possibility” that certain data was being double-counted.⁶⁹ Dr. Kohler also admitted that labs could confirm only presence of a drug, not causality—even though medical examiners provide a “cause” of death.⁷⁰ Steve Perch, the Chief Toxicologist in the Summit County Medical Examiner’s Office, stated that Summit County failed to track certain other illicit drug-related deaths in their Annual Reports.⁷¹

43. Other medical professionals who provided testimony on behalf of the Bellwether counties similarly casted doubt on the reliability of their data. For example, George Sterbenz, the Summit County Chief Deputy Medical Examiner, testified that challenges exist to attributing cause and access to drugs, as the Medical Examiner Office cannot determine the history and origins of a person’s drug or addiction history from the aggregate data they receive.⁷² Gary Guenther, the Chief Investigator for the Summit County Medical Examiner’s Office, identified inconsistencies in protocols, changes in drug use over time, and even mentions the impact of media reports on reporting patterns.⁷³ Claire Kasper, a Forensic Toxicologist for the Office of the Cuyahoga County Coroner and Medical Examiner, suggested that not all county toxicology protocols are the same.⁷⁴

“lose confidence in the reliability of positive results” from the county’s testing equipment for fentanyl and analogs of Fentanyl).

⁶⁹ Deposition of Dr. Lisa Kohler, Chief Medical Examiner, Summit County (July 31, 2018) at 239:8-12; 55:9-19. (Hereinafter “Kohler Deposition”).

⁷⁰ Dr. Kohler stated that as to the category on the Annual Report, “[d]rugs most commonly found as the cause of death, these are the drugs that are appearing on the death certificate.” She stated that the report is “not saying that the 123 carfentanil deaths were solely due to carfentanil. It’s just that 123 of the deaths had carfentanil present and it was contributed as a cause. That person may have had carfentanil, cocaine and fentanyl in their system. So . . . that person is going to populate three columns [in the Annual Report].” Kohler Deposition, at 246:15-247:3. Dr. Kohler also admitted that suicides are likely undercounted because, in the case of a drug overdose, the Summit County Medical Examiner’s Office classifies it as an “accidental death as opposed to suicide unless [there is] some sort of indication that it was an intent to cause self-harm.” Kohler Deposition, at 51:2-18.

⁷¹ Deposition of Steve Perch, Toxicologist and Medical Examiner, Summit County (October 18, 2018) at 125-128, 139:6-11. (Hereinafter “Perch Deposition”) Specifically, Mr. Perch testified that methamphetamine is a leading cause of death in Summit County but methamphetamine-related deaths are not tracked in the Summit County Annual Reports and he admitted this was a clear oversight—“Somebody screwed up,” by not tracking meth-related deaths. and per Mr. Perch, he doubts the data is accurate if “you’re missing a drug that should be there.” Perch Deposition, at 125-128, 139:6-11.

⁷² Deposition of Dr. George Sterbenz, Chief Deputy Medical Examiner, Summit County, (October 17, 2018) at 85:6-11, 95:16-101:25; 77-80, 108:3-9.

⁷³ Deposition of Gary Guenther, Chief Investigator, Summit County, (October 16, 2018) at 67:18-25, 91:21-93:14, 95:10-23, 109:8-111:17, 114:5-24, 182:10-19, 185:6-16, 186:4-10.

⁷⁴ Deposition of Claire Kaspar, Forensic Toxicologist, Cuyahoga County (January 15, 2018) at 110:16-113:5.

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These individuals and others⁷⁵ who testified on behalf of the Plaintiffs suggest that Plaintiffs’ data cannot reliably be used to evaluate opioid overdose and deaths.

VI. THE DATA SHOW MULTIPLE CONTRIBUTING FACTORS TO OPIOID USE DISORDER

44. Although exploring potential causal links is essential in epidemiology, epidemiologists nevertheless recognize that causation is not a uniform concept.⁷⁶ In practice, public health practitioners and epidemiologists may evaluate individual risk factors as a potential cause.⁷⁷ The true “cause” of a disease, however, is “the total assemblage of conditions that are together sufficient for the disease.”⁷⁸ Multiple individual risk factors may work together to cause a certain outcome.

45. Plaintiffs’ experts focus primarily on their allegations of Defendants’ misconduct as alleged in their complaints. But they do not consider the many observed factors relevant to understanding and explaining the current overdose crisis. These include economic factors such as increased illicit drug supply and lower illicit drug prices, sociological factors such as deteriorating community conditions, and medical factors such as the presence of mental health conditions or previous substance use treatment.⁷⁹

46. As discussed, there has been some baseline level of illicit drug use and a reported pattern of increased overdoses in the United States beginning in 1979.⁸⁰ Against this backdrop, Jalal et al. (2018) observed that the “annual sum of all drug overdose mortality rates follows a remarkably smooth mathematical trajectory” that “closely tracks along an exponential growth curve.”⁸¹ Jalal noted that the first half of this exponential trajectory “predates the current opioid epidemic,”⁸² and so predates the onset of increased opioid prescribing that Plaintiffs’ experts attribute to Defendants’ alleged conduct. Despite the long-lasting pattern of drug misuse, Plaintiffs’ experts fail to consider whether, and to what extent, various illicit substances, including

⁷⁵ See e.g., Deposition of Hugh Shannon, Director of Operations, Cuyahoga County, (January 14 2018, and January 17, 2018) at 34:17-35:14

⁷⁶ Parascandola, M., & Weed, D. L. (2001). Causation in epidemiology. *Journal of Epidemiology & Community Health*, 55(12), 905. doi:10.1136/jech.55.12.905.

⁷⁷ Parascandola (2001), p. 907.

⁷⁸ Parascandola (2001), p. 907.

⁷⁹ Jalal, H., Buchanich, J. M., Roberts, M. S., Balmert, L. C., Zhang, K., and Burke, D. S. (2018). Changing dynamics of the drug overdose epidemic in the United States from 1979 through 2016, *Science* 361 (6408). <http://dx.doi.org/10.1126/science.aau1184>; see also Case, A., & Deaton, A. (2015) Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st Century. *Proceedings of the National Academy of Sciences of the United States of America*, 112 (49), 15080. Retrieved from www.pnas.org/cgi/doi/10.1073/pnas.1518393112.

⁸⁰ Jalal et al.,(2018).

⁸¹ Jalal et al.,(2018).

⁸² Jalal et al.,(2018).

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illicit opioids, have operated as independent contributing factors to American drug misuse generally, and opioid misuse specifically.

47. Within the growth pattern of drug misuse, the drug of choice has varied over time. Jalal et al. accordingly concluded that the “overdose epidemic is a composite of multiple subepidemics” of different drugs.”⁸³ That is, “[t]he increase in drug poisoning mortality in 2016 is due to increased mortality from multiple drug-specific subepidemics: synthetic opioids (most likely fentanyl) among males, whites, and those in urban counties; heroin among young adults; prescription opioids among the middle-aged and blacks; and cocaine and methamphetamine among a wider age range, males, and whites.”⁸⁴

48. Choices in drug consumption are necessarily influenced by drug availability and are also sensitive to prices of those available drugs. In the *New England Journal of Medicine*, Compton (2016) stated that a “key factor underlying the recent increases in rates of heroin use and overdose may be the low cost and high purity of heroin.”⁸⁵ According to Compton, multiple other studies similarly indicated that the cost and availability of heroin were “primary factors” in initiation of heroin use.⁸⁶ Moreover, Compton found that “[t]hese reasons were generally consistent across time periods from the late 1990s through 2013.”⁸⁷ Jalal similarly explained that “[e]conomic and technological ‘push’ factors may be at work to increase supply, such as improved communications and supply chains, efficiencies in drug manufacturing, and expanding drug markets, leading to lower prices and higher drug purities.”⁸⁸ In addition, Case and Deaton (2015) determined that the “falling prices and rising quality of heroin” and “availability in areas where heroin had been previously largely unknown” have contributed to heroin use.⁸⁹

49. Furthermore, with the introduction and rise of illicit drugs into American drug supply channels, the potency of such substances has become a major factor in the increase in overdose deaths. In 2015, the DEA and CDC released an alert and advisory about increased fentanyl drug reports and deaths, which can be attributed in part to the mixing of illicitly manufactured fentanyl into the heroin supply chain by drug traffickers and persons misusing opioids.⁹⁰ O’Donnell (2017) reported that drug overdose deaths in 2016 were “partially driven by a fivefold increase [since 2013] in overdose deaths involving synthetic opioids (excluding

⁸³ Jalal et al.,(2018).

⁸⁴ Jalal et al.,(2018).

⁸⁵ Compton, W. M., Jones, C. M., & Baldwin, G. T. (2016). Relationship between Nonmedical Prescription-Opioid Use and Heroin Use. *New England Journal of Medicine* 374, 158. 10.1056/NEJMra1508490

⁸⁶ Compton et al., (2016), p. 158.

⁸⁷ Compton et al., (2016) , pp. 158-59.

⁸⁸ Jalal et al.,(2018).

⁸⁹ Case. A. & Deaton, A. (2015).

⁹⁰ O’Donnell, J. K., Gladden, R. M., and Seth, P. (2017). Trends in deaths involving heroin and synthetic opioids excluding methadone, and law enforcement drug product reports, by census region — United States, 2006–2015. *MMWR Morb Mortal Wkly Rep* 2017;66: 901. DOI: <http://dx.doi.org/10.15585/mmwr.mm6634a2External>.

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methadone).⁹¹ The synthetic substances accounting for this increase are far more potent, and therefore carry significantly higher risks, than most prescription opioid medications. For instance, illicitly manufactured fentanyl is 50 to 100 times more potent than morphine.⁹² Fentanyl analogs include carfentanil, which is estimated to be 10,000 times more potent than morphine.⁹³ Because of their heightened potency, medical examiners and coroners conclude that such synthetic opioids “play a causal role in almost all fatal opioid overdoses in which they were detected.”⁹⁴ At least half of opioid overdose deaths in Ohio, for instance, tested positive for fentanyl.⁹⁵

50. Preexisting or co-occurring mental health conditions play a role in the increase in overdose deaths. In a study exploring suicidal intent among drug users experiencing non-fatal overdoses, Neale (2000) found that “[h]eroin was implicated in the majority of overdose incidents,” and “non-fatal illicit drug overdoses are often motivated by suicidal intent.”⁹⁶

51. Consumption habits within certain high-risk populations also figure in increased opioid mortality. Former inmates are one such high-risk population.⁹⁷ A recent retrospective cohort study involving former North Carolina inmates who were released between 2000 and 2015 found that opioid overdose mortality increase among this population was more pronounced than in the general population of the state.⁹⁸ In the first year after release, former inmates had almost eleven times the risk of opioid overdose deaths than the general population, and this risk was highest in the first two weeks after release.⁹⁹ The authors of the study concluded that these high opioid overdose deaths rates “may be attributable to decreased tolerance as a result of incarceration-induced drug use abstinence.”¹⁰⁰ Also, “[d]epending on the length of incarceration, the potency of opioids may have changed while these individuals were incarcerated, . . . which may catch them unaware upon first use after release.”¹⁰¹

52. Overdose data cannot be considered independently from other health indicators in a given population. “Population health addresses the health status and health issues of the

⁹¹ O’Donnell, J.K., Halpin, J., Mattson, C., Goldberger, B.A., Gladden, R.M. (2017). Deaths involving Fentanyl, Fentanyl analogs, and U-47700—10 states, July-December 2016. *Morbidity and Mortality Weekly Report*, 63 (43), 1197.

⁹² O’Donnell *et al.*, (2017), p. 1197.

⁹³ O’Donnell *et al.*, (2017), p. 1197.

⁹⁴ O’Donnell *et al.*, (2017), p. 1199.

⁹⁵ O’Donnell *et al.*, (2017), pp. 1198-99; *see also* Drug Enforcement Administration. Officer Safety Alert: Carfentanil: A Dangerous New Factor in the U.S. Opioid Crisis. Retrieved from https://www.dea.gov/sites/default/files/divisions/hq/2016/hq092216_attach.pdf.

⁹⁶ Neale, J. (2000). Suicidal intent in non-fatal illicit drug overdose. *Addiction*, 95 (1), 91-92.

⁹⁷ Ranapurwala, S. I., Shanahan, M.E., Alexandridis, A.A., Proescholdbell, S.K., Naumann, R.B., Edwards Jr., D.E., and Marshall, S.W. (2018). Opioid overdose mortality among former North Carolina inmates: 2000-2015. *American Journal of Public Health*, 108 (9). 1207-1213, p. 1210.

⁹⁸ Ranapurwala *et al.* (2018), p. 1210.

⁹⁹ Ranapurwala *et al.* (2018), p. 1210

¹⁰⁰ Ranapurwala *et al.* (2018), p. 1210.

¹⁰¹ Ranapurwala *et al.* (2018), p. 1210.

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aggregate population. It brings significant health concerns into focus and addresses ways in which communities, healthcare providers, and public health organizations can allocate resources to overcome the problems that drive poor health conditions in the population, e.g. diabetes, obesity, autism, heart disease, etc.”¹⁰² Population health plays a role in an individual’s risk for a given disease or condition.¹⁰³ This means that “an individual’s risk of illness cannot be considered in isolation from the disease risk for the population to which he or she belongs.”¹⁰⁴ For example, “someone in the United States is more likely to die prematurely from a heart attack than someone living in Japan, because the population distribution of high cholesterol in the United States as a whole is higher than the distribution in Japan.”¹⁰⁵ Therefore, it is impossible to fully understand the causes of the opioid overdose crisis in the Bellwether counties without considering the overall population health in those counties.

53. Therefore, when considering these factors, it is important to recognize that clusters of reported opioid related overdoses and deaths are local in nature, may be driven by local issues, and therefore vary across localities, jurisdictions, and states. There are wide variations in these external factors across jurisdictions. Plaintiffs’ experts did not consider many factors on a local level (if at all).¹⁰⁶

54. In addition, Plaintiffs’ experts have not attempted to quantify for or determine the extent of the influence of various confounding factors. Professor Lembke testified that she has not done any quantitative analysis to determine the specific contribution that various factors, such as economic disadvantage and preexisting social and economic problems, contributed to opioid-related mortality risks.¹⁰⁷

55. Specific to Plaintiffs’ counties, the 2018 Cuyahoga County Community Health Assessment suggests that the opioid overdose crisis should not be evaluated independently from a confluence of health, economic, sociopolitical, and educational factors.¹⁰⁸ “From the perspective of substance abuse and mental health, while the opioid crisis is acute, it is among several interrelated problems the community faces. Suicide risk, violence prevention, and increased emphasis on trauma-informed care are also areas of need in this realm.”¹⁰⁹ The Assessment explains that “[l]ack of management of chronic health conditions, poverty, and longstanding health inequities across race and class,” as well as “the problem of structural racism”

¹⁰² HIMISS. (2019) Population Health. Retrieved from <https://www.himss.org/population-health>.

¹⁰³ Institute of Medicine (US) Committee on Assuring the Health of the Public in the 21st Century. (2002). Understanding Population Health and Its Determinants, in *The Future of the Public's Health in the 21st Century*. 2; Washington (DC): National Academies Press (US). Retrieved from: <https://www.ncbi.nlm.nih.gov/books/NBK221225/>.

¹⁰⁴ Understanding Population Health and Its Determinants (2002).

¹⁰⁵ Understanding Population Health and Its Determinants (2002).

¹⁰⁶ Deposition of Professor David Cutler (April 27, 2019) at 488:9-497:3 (hereinafter “Cutler Deposition”).

¹⁰⁷ Lembke Deposition, at 171-73; *see also* Cutler Deposition at 488:9-497:3.

¹⁰⁸ Adams, B., Allan, T., Cheatham, C., Cirillo, P., Cook, K., Cracium, K. ... Wesolowski, K. (2018). 2018 Cuyahoga county community health assessment, p. 18. Retrieved from <http://hipcuyahoga.org/wp-content/uploads/2018/11/2018CuyahogaCountyAssessmentFinal.pdf>.

¹⁰⁹ Adams, B. *et al.* (2018), p. 18.

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are “some of the leading issues impacting health” in Cuyahoga County.¹¹⁰ Moreover, “[t]here is a growing realization that social determinants of health, such as access to quality education, transportation and jobs, play a large role in impacting health and the importance of addressing a broad set of needs if the community is to move the needle on health status.”¹¹¹

VII. CONCLUSION

56. The current opioid crisis appears to be one of increased overdoses and mortality. The evidence and data upon which Plaintiffs’ experts rely are insufficient to support their conclusions. As discussed above, multiple factors must be considered to understand the cause of an epidemic. There is a complexity to the opioid overdose crisis that is not being acknowledged by Plaintiffs.

¹¹⁰ Adams, B. *et al.* (2018), p. 18.

¹¹¹ Adams, B. *et al.* (2018), p. 18.

Dated: May 10, 2019

A handwritten signature in dark ink, appearing to read "R. Lyerla", is written over a horizontal line.

Robin Lyerla